December 20, 2006

TO: PARTIES INTERESTED IN EVALUATION REPORTS ON COLD-FORMED STEEL FRAMING MEMBERS

SUBJECT: Proposed Revisions to the Acceptance Criteria for Cold-formed Steel Framing Members, Subject AC46-0207-R1 (DM/RK/BG)

Hearing Information:
Thursday, February 8, 2007
8:00 a.m.
The Westin Los Angeles Airport
5400 West Century Boulevard
Los Angeles, California 90045
(310) 216-5858

Dear Madam or Sir:

The enclosed proposed revisions to the subject acceptance criteria will be considered at the Evaluation Committee hearing noted above. The revisions were requested by SSMA in their July 31, 2006, letter (enclosed).

The ICC-ES staff concurs with the revisions except for the following items:

Section 1.4:

The definition section is unnecessary, since all of the definitions are in either the IBC or the reference documents.

Section 3.1.1:

SSMA is recommending that we change the 5 psf limit for nonstructural grades of steel to 10 psf. The applicant notes that ASTM C 645 has the 10 psf limit and that AISI is proposing a change to their document, AISI/COFS/GP, to increase the limit from 5 psf to 10 psf. The concern with increasing the limit to 10 psf is that Chapter 22 of the IBC references AISI/COFS/GP-2004, which states that nonstructural steel is allowed for studs up to a 5 psf lateral force only. To change the criteria on the basis of a proposed change to the AISI document creates a conflict with the code.
Section 3.1.2:

The ICC-ES staff is not in agreement with the proposed change since it inaccurately paraphrases the statements in the reference document. The new text which SSMA added to Section 3.1.2 indicates that the NASPEC “states that the steel thickness shall not be less than 95% of the design thickness.” This statement leaves out two important items. The first item is about “cold-formed products delivered to the job site.” The second item is the fact that the thickness “shall not at any location be less than 95 percent.” The second item does not indicate an average thickness. As a result, the thickness shall not be less than 95 percent at any location.

Section 3.1.3:

The ICC-ES staff does not agree with the changes for the reasons cited under Section 3.1.1. Therefore, the 5 psf limit should remain.

Section 3.2.1:

ICC-ES suggests removing the strikeout from this section. The 2006 IBC references the AISI/COS/NASPEC-SUP04. Removing this reference would also be in conflict with Section 3.2.2, which has this reference.

Section 3.2.2:

Since Section 3.2.1 is for “Sectional Properties” (cross-sectional area, moment of inertia, section modulus, radius of gyration, design thickness, weight, etc.), it would appear that Section 3.2.2 would be for structural performance of the members or member capacities. A title should be added to this section that would convey what is being addressed. As it is written, only Sections C2 and C4 are being addressed for structural performance. Staff believes this should be expanded to include all of Chapter C and may need to include Chapters D and E as well. The last concern is that the next to last sentence only addresses strength and omits stiffness. Stiffness should also be addressed.

Section 4.2:

1. In lieu of the SSMA recommended revision, ICC-ES staff suggests that the first two lines of Section 4.2, “For members with modifications such as web perforations, or members that exceed limitations in Section C3 and C4 of AISI-NASPEC,” be replaced with, “For members whose strength and stiffness can not be calculated in accordance with Chapter C of AISI-NASPEC.” This is consistent with the first two lines in Section 4.1.

2. ICC-ES staff is not in agreement with removing “F1” from the 7th line of this section. The reasons given by SSMA for their proposed revision are:
“...testing should be permitted in accordance with chapter F in its entirety, rather than just section F1. Therefore, “F1” has been changed to “F” in the first sentence.”

“A mechanism needs to exist to allow cold-formed steel members to be tested even if they do not have modifications or even if they do not exceed the limitations in the NASPEC. This is because even if a member can have its properties (strength and stiffness) calculated in accordance with the code, it should not necessarily preclude testing to determine properties. A specific example would be hat-shaped members with complex lips. Some of these configurations in multi-span configurations with uniform load exhibit much greater capacities than what is found by calculating their span and capacity using the Specification. Therefore, verbiage has been added to permit testing in accordance with chapter F, in accordance with section 1.1(a) of NASPEC.”

The concern with this statement is that AC46 Section 4.2 is “For members that exceed limitations specified in the applicable specifications or do not conform to the requirements of applicable specification.” To indicate that all of Chapter F can be used for this appears to be, in our opinion, a misinterpretation of the three sections inside of Chapter F. Chapter F of the NASPEC is divided into three sections, F1, F2 and F3.

F1 is titled “Tests for Determining Structural Performance”. F1.1 is for LRFD and LSD design, and states, “Any structural performance which is required to be established by tests shall be evaluated in accordance with the following performance procedures...” F1.2 is for ASD and states, “Where the composition or configuration of elements, assembles, connections or details of cold-formed steel structural members are such that calculation of their strength cannot be made in accordance with the provisions of this Specification, their structural performance shall be established from tests and evaluated in accordance with Section F1.1, except as modified in this section for allowable strength design.”

Section F2 is titled “Tests for Confirming Structural Performance” and says, “For structural members, connections, and assemblies for which the nominal strength [resistance] can be computed according to this Specification or its specific references, confirmatory tests shall be permitted to be made to demonstrate the strength is not less than the nominal strength [nominal resistance], $R_n$, specified in this Specification or its references for the type of behavior involved.” This section should not be used in the SSMA’s example noted above concerning the multi-span hat shape member since F2 only confirms that the member’s strength is not less than the calculated strength.
Section F3 is titled “Tests for Determining Mechanical Properties” and states, “Tests for determination of mechanical properties of full sections to be used in Section A7.2 shall be made as specified below…” Section A7.2 of the Specification is for “Strength Increase from Cold Work of Forming,” and is not concerned with “members that exceed limitations specified in the applicable specifications or do not conform to the requirements of applicable specification.”

Therefore, it appears in reviewing all three sections of Chapter F, only Section F1 applies to “members that exceed limitations specified in the applicable specifications or do not conform to the requirements of applicable specification…”

3. The ICC-ES staff has concern with the phrase that was added by SSMA toward the end of the first paragraph of Section 4.2, “…or in accordance with Section A1.1(a) of the NASPEC.” This proposed revision would appear to incorrectly allow mixing of these two sections, A1.1(a) and A1.1(b), resulting in an inappropriately low safety factor for products evaluated using the rational engineering analysis procedure of Section A1.1(b). Section A1.1(a) in the NASPEC is a test only procedure and is covered in the first half of Section 4.2 of AC46.

4. In the last paragraph of this section, there is a concern about not stating a rate of load. ICC-ES staff requests input on this issue and requests suggestions on what rate should be used.

Section 4.3:

Section 4.3 describes the test procedure required for web crippling tests. AISI test procedure TS-9, referenced in this section, does not state what load rate should be used. Since the load rate is being removed from Section 4.2, there is no information on what rate to use. ICC-ES requests input on this issue and requests suggestions on what rate should be used.

Section 5.0:

SSMA has revised Section 5.0 and removed the description of what is to be included on the identification label, stating that “Each cold-formed steel framing member shall be marked in accordance with the applicable building code.” The concern is that the IBC does not have specific labeling requirements. To resolve the labeling issue, a search of the reference documents would have to occur and a determination made on which one governs. In the IRC, there may be differences in the requirements and the reference document requirements. The question again is, which document would govern if the wording suggested by SSMA is
used? The ICC-ES staff suggests that the requirements for the labels be included in the criteria to eliminate any confusion.

ASTM C 645 and C 955, as well as AISI General Provisions note the spacing of labels to be a maximum of 48 inches, which is a closer spacing than the SSMA proposal. Since the ASTM documents and AISI document are referenced in the 2006 IBC and IRC, changing the spacing would make the criteria inconsistent with the codes.

You are cordially invited to submit written comments, or to attend the Evaluation Committee hearing and present verbal comments. Written comments will be forwarded to the committee, prior to the hearing, if received by January 23, 2007. If the deadline is missed, you must provide 35 copies of the submittal material, collated, stapled and three-hole punched, to the Los Angeles business/regional office before the committee meeting. Your consideration in providing written responses by the deadline would be greatly appreciated. Consideration of written comments and presentations of a significant nature received the week of the hearing or at the hearing may be delayed until a future meeting as the committee and staff may not have adequate time for review.

NEW FOR THE FEBRUARY 2007 MEETING! On a trial basis, starting with the February 2007 Evaluation Committee meeting, comments from interested parties that are submitted in response to proposed acceptance criteria will be posted on the ICC-ES web site prior to the meeting. Postings will occur shortly after the comment deadline (January 23, 2007). Staff memos responding to some of the comments, and comments received after the January 23 deadline, will be posted on February 1, 2007.

The purpose for posting the comments prior to the meeting is to help interested parties be better prepared to discuss the issues at the meeting.

Any written material submitted for committee consideration will be available for public distribution as set forth in Section 2.7 of the Rules of Procedure for the Evaluation Committee (copy enclosed).

Visual aids (including, but not limited to, charts, overhead transparencies, slides, videos, or presentation software) for viewing at meetings will be permitted only if the presenter provides to ICC-ES, before the presentation, a copy of the visual aid(s) in a medium that can be retained by ICC-ES with its record of the meeting, and that can also be provided to interested parties.

Your cooperation is requested in forwarding to the Los Angeles business/regional office all material directed to the Evaluation Committee. Parties interested in the deliberations of the committee should refrain from communicating, whether in writing or verbally, with committee members regarding agenda items. The committee reserves the right to refuse communications that do not comply with this request.
Newly approved acceptance criteria may involve test methods or test protocols that are not currently included in the scope of testing services offered by accredited testing laboratories. As noted in the ICC-ES Rules of Procedure for Evaluation Reports, the scope of the laboratory’s accreditation must include the type of testing that is to be reported to ICC-ES. We encourage accredited laboratories to expand their scopes of accreditation to include testing under newly approved acceptance criteria. Please note that testing laboratories must be accredited by the International Accreditation Service (IAS) or by another accreditation body that is a signatory to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement. For further information, please contact IAS at (562) 699-0541, extension 3309, or send an e-mail to pmccullen@iasonline.org.

If you have any questions, please contact the undersigned at (800) 423-6587, extension 5681, or Russ Krivchuk, P.E., senior staff engineer, at extension 3275. You may also reach us by e-mail at es@icc-es.org.

Yours very truly,

David Musselwhite, P.E.
Senior Staff Engineer

DM/RK/II

Enclosures

cc: Evaluation Committee
July 31, 2006

Mr. David Musselwhite  
International Code Council Evaluation Service  
900 Montclair Road, Suite A,  
Birmingham, Alabama 35213  

Dear Mr. Musselwhite,

As discussed in our July 12 meeting, the Steel Stud Manufacturers Association (SSMA) has drafted suggested changes to Acceptance Criteria AC 46: Acceptance Criteria for Cold-Formed Steel Framing Members. Attached to this letter are three documents:

- The first document is the text of the Acceptance Criteria, with SSMA suggested changes shown. Rather than strikeout and underline, this shows the new text added, and the removed text off to the right. Note that the only comment in this document is that the sections have not been renumbered to account for material added or deleted; this should make it easier to coordinate with the existing document.
- The second document is the list of comments by the Steel Stud Manufacturers Association. These comments are numbered to correspond with the existing Acceptance Criteria.
- The third document is a compilation of the definitions dealing with loadbearing, nonloadbearing, structural, and nonstructural cold-formed steel framing members.

Let me know if you have questions or comments, or want or need us to resubmit this in a different format.

Sincerely,

STEEL STUD MANUFACTURERS ASSOCIATION

[Signature]

Don Allen  
Technical Director

Enclosure: Markups, Comments, Structural Member
AC 46: ACCEPTANCE CRITERIA FOR COLD-FORMED STEEL FRAMING MEMBERS

1.0 INTRODUCTION

Purpose: The purpose of this criteria is to establish requirements for cold-formed steel framing members to be recognized in an ICC Evaluation Service, Inc. (ICC-ES), evaluation report under the 2006 International Building Code® (IBC), the 2006 International Residential Code® (IRC) and the 1997 Uniform Building Code™ (UBC). Basis of recognition under the IBC is the United States of America provisions of AISI-NASPEC and AISI/COFS/GP as referenced in IBC Sections 1604.3.3 and 2210. Basis of recognition under the IRC are IRC Sections R301.1.3, R505, R603, and R804. Basis of recognition under the UBC is UBC Chapter 22, Division VI or VII, or AISI 1996 Specifications.

The reason for the development of this criteria is to provide guidelines for the evaluation of cold-formed steel framing, to comply with the provisions and requirements of Chapter 22 of the IBC, Chapters 3, 5, 6 and 8 of the IRC, and Chapter 22 of the UBC and to provide detailed requirements for a quality control system to be used in the manufacturing of steel framing members being used in the design and construction of cold-formed steel framing members.

1.2 Scope: This acceptance criteria applies to cold-formed steel framing members used in light-frame construction.

1.3 Codes and Referenced Standards:


1.3.3 1997 Uniform Building Code™ (UBC).


1.3.6 AISI/COFS/GP 2004, AISI Standard for Cold-Formed Steel Framing—General Provisions, American Iron and Steel Institute (AISI).

1.3.7 AISI/COFS/TRUSS 2004, AISI Standard for Cold-Formed Steel Framing—Truss Design, American Iron and Steel Institute (AISI).

1.3.8 AISI/COFS/HEADER 2004, AISI Standard for Cold-Formed Steel Framing—Header Design, American Iron and Steel Institute (AISI).


1.3.9 Specification for Design of Cold-Formed Steel Structural Members, 1986 with December 1989 addendum, American Iron and Steel Institute (AISI) (referred to as 1986 ASD Specifications).

1.3.10 Load and Resistance Factor Design Specification for Cold-Formed Steel Structural Members, March 1991, American Iron and Steel Institute (AISI) (referred to as 1991 LRFD Specifications).

1.3.11 Specification for the Design of Cold-Formed Steel Structural Members, 1996 edition, American Iron and Steel Institute (AISI) (referred to as 1996 Specifications).

1.3.12 ASTM A 370-97a, Test Methods and Definitions for Mechanical Testing of Steel Products, ASTM International.


1.3.14 TS 9-05, Standard Test Method for Determining the Web Crippling Strength of Cold-Formed Steel Beams, American Iron and Steel Institute (AISI).
1.4 Definitions:

1.4.1 *structural member, n*—a member in a steel framed system in which the loading exceeds any of the following conditions: a transverse load of 20 lbf/ft (290 N/m) of member length, or an axial load, exclusive of sheathing, of 200 lbf (890 N) per member.

1.4.2 *nonstructural wall stud, n*—a member in a steel framed wall system which is limited to a lateral (transverse) load of not more than 10 lbf/ft2 (480 Pa), a superimposed vertical load, exclusive of sheathing materials, of not more than 100 lbf/ft (1460 N/m), or a superimposed vertical load of not more than 200 lbs (890 N).

2.0 GENERAL

The following information shall be submitted:

2.1 Data concerning material specifications; section properties; maximum allowable heights; maximum allowable spans and/or maximum allowable loads; and lateral, mechanical or material bracing requirements.

2.2 Method of field identification.

2.3 Quality control program.

2.4 Data in support of an application for recognition only under the IRC shall verify compliance with Sections R505, R603 and R804 of the IRC and the requirements noted in this criteria except for Section 4.0.

2.5 Testing Laboratories: Testing laboratories shall comply with Section 2.0 of the ICC-ES Acceptance Criteria for Test Reports (AC85) and Section 4.2 of the ICC-ES Rules of Procedures for Evaluation Reports.

2.6 Test Reports: Test reports shall comply with AC85. Details describing the test configuration, test methods and test procedures, including load application rate, shall be identified in the test report.

3.0 TEST AND PERFORMANCE REQUIREMENTS

3.1 Material Specifications:

3.1.1 *Steel:* Steel specifications shall comply either with Section A.3 of the AISI 1986 ASD Specifications or AISI 1991 LRFD Specifications, as referenced in UBC Chapter 22, Division VII or VI, respectively; with Section A.3 of the 1996 Specifications, for the UBC; or with Section A3 of the AISI/COFS/GP-2004, for the IBC and IRC. Nonstructural grades of steel shall be limited to interior nonload-bearing walls with lateral loads of 10 psf (240 Pa) or less.

3.1.2 *Thickness:* Minimum steel thicknesses shall comply with Section A3.4 of either the 1986 ASD Specifications; 1991 LRFD Specifications; 1996 Specifications; or with Section A2.4 of AISI-NASPEC, which states that the steel thickness shall not be less than 95% of the design thickness. Thicknesses shall also comply with section A5.1 of AISI/COFS/GP. Other thicknesses may be considered, provided substantiating data showing compliance with the applicable code and this criteria are submitted.

3.1.3 *Protective Coating:* For use with the IBC and IRC, a minimum of G60 (or equivalent) is required for all applications with the exception of minimum G40 (or equivalent) for interior nonload-bearing walls.

3.2 *Cold-formed Steel Framing Members:* Evaluation reports on cold-formed steel framing members shall address the section properties and design approach as applicable.

3.2.1 *Section Properties:* Section properties shall be determined in accordance with AISI-NASPEC for recognition under the IBC; and 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications for recognition under the UBC. Structural properties data for steel members shall include the minimum information noted in Appendix C of this criteria. Information on additional properties is optional and can be furnished.

3.2.2 *Capacity:* Capacity of members shall be determined in accordance with Section C2 and C4 of AISI-NASPEC with AISI/COS/NASPEC-SUP04 for recognition under the IBC; and Sections C2 and C4 of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications for recognition under the UBC. For members that exceed limitations specified in the applicable specifications or do not conform to the requirements of applicable specifications, full-scale tests are necessary to determine applicable strength. See Section 4.2 (4.3 for web crippling) of this criteria.

4.0 DESIGN AND TESTING METHODS

4.1 Design Methods: This section is for cold-formed steel members that can be designed in accordance with Section C of AISI-NASPEC with AISI/COS/NASPEC-SUP04 for recognition under the IBC; and Section...
C of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications for recognition under the UBC.

Data concerning section properties, maximum allowable heights, spans and/or loads shall be submitted showing compliance with AISI-NASPEC for recognition under the IBC, and UBC Chapter 22, Division VI or VII, or 1996 Specification, for recognition under the UBC. The analytical approach noted in Appendix A of this criteria can be used as a supplement to UBC Chapter 22, Division VI or VII, or 1996 Specification when appropriate.

4.2 Testing Methods: For members with modifications that exceed limitations in Section C3 and C4 of AISI-NASPEC used under the IBC and Section C3 and C4 of the 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications used under the UBC, testing shall be conducted in accordance with Section F of the AISI-NASPEC used under the IBC and of the 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications used under the UBC, except for web crippling. Web crippling shall be tested in accordance with Section 4.3 below. Alternatively, under the IBC and IRC, design strength [allowable design strength] and stiffness may be determined by rational analysis based on appropriate theory and engineering judgment when supported by applicable test data. Specifically, design strength [allowable design strength] shall be determined from calculated nominal strength [resistance] by applying the resistance factors [factors of safety] of Section A1.1(b) of the ANSI NASPEC, or in accordance with Section 1.1(a) of the NASPEC. Test data shall demonstrate that strength and stiffness are not less than the nominal strength and stiffness predicted by the analysis.

Testing programs under Section 4.2 of this criteria shall be submitted to the ES staff for review and acceptance prior to any testing being performed. The number of test specimens and test procedures and rate of loading shall be included in the test program submittal.

4.3 Web Crippling Tests:

4.3.1 Testing shall be conducted in accordance with AISI TS-9 on three similar specimens. Two series are required for each assembly: one series for interior reactions and a second series for end reactions. The load rate used under AISI TS-9 shall be reported. Both end reactions and interior reactions shall be evaluated in accordance with the conditions set forth in the applicable specification. The tested bearing width will be the minimum width recognized in the evaluation report. For member profiles available in multiple thicknesses, only the least thickness in each profile is required to be tested.

4.3.2 Conditions of Acceptance: The members shall be loaded to failure or dysfunctional distortions and the loads causing web crippling shall be recorded. The determination of nominal resistance, \( R_n \), shall be based on Sections F1 of AISI-NASPEC used under the IBC and Sections F1 of the 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications used under the UBC. For ASD, the allowable design strength, \( R_a \), is as follows:

\[
R_a = R_n / \Omega
\]

where:

\[
\Omega = 1.6^{\frac{\phi}{\Omega}}
\]

For LRFD, equation F1.1-1 of AISI-NASPEC applies under the IBC, and equation F1-1 in the 1991 LRFD Specifications or equation F1.1-1 in the 1996 Specifications applies under the UBC.

The results shall be compared to the design equations in Section C3.4 of AISI-NASPEC for use under the IBC, and Section C3.4 of the 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications for use under the UBC. The lowest result, from either testing or calculations, will determine the allowable value noted in the evaluation report. Where design capacities are derived from testing, the value will apply to heavier thicknesses. If the calculated web crippling value is the lowest value, web crippling capacities for heavier thicknesses are permitted to be calculated in accordance with the applicable specification.

5.0 FIELD IDENTIFICATION

Each cold-formed steel framing member shall be marked in accordance with the applicable building code. In addition, marking should include a legible label, stamp or embossment, at a maximum of 48 inches (1219 mm) on center, indicating the evaluation report number (ESR-XXXX); the acronym “ICC-ES”; and inspection agency name or logo and manufacturing equipment serial number (if cold-formed steel framing members are field-manufactured in accordance with Section 6.1.2).

6.0 QUALITY CONTROL

3 of 9: Markups
6.1 **Manufacturing:**

6.1.1 **Manufacturing Facility:** The manufacturer of the cold-formed steel framing members shall maintain an in-house quality control program. The type of material utilized and the level of quality assurance shall be documented in a quality control manual submitted to ICC-ES. The quality control manual shall include sufficient detail to verify that each type of steel complies with that specified in the evaluation report.

6.1.2 **Field Manufacturing:** The manufacturers of field-manufactured cold-formed steel framing members shall maintain a quality control program. Each field manufacturer shall be listed in a current ICC-ES evaluation report. Each incoming steel coil shall have mill certification. The type of material utilized and the level of quality assurance shall be documented in a field quality control manual that shall include sufficient detail to verify that each type of steel complies with that specified in the evaluation report and with the requirements in Sections 6.2 through 6.7 of this acceptance criteria, excluding Subsection 6.2.2. In addition, the quality control manual shall address the following:

- A monitoring program for each piece of field-manufacturing equipment, to be provided by an inspection agency accredited by the International Accreditation Service (IAS), or as otherwise acceptable to ICC-ES, with inspections to occur at a minimum frequency of once every quarter.
- Environmental conditions, such as temperature range and moisture limitations, for the operation of the field-manufacturing equipment.
- Labeling of the cold-formed steel framing members with the serial number of the field-manufacturing equipment and with information in accordance with Section 5.0 of this acceptance criteria.

6.2 **Tests shall verify the following:** Steel thickness (uncoated), yield strength, tensile strength, total elongation, chemical composition and galvanized coating thickness. Where required by Section A3.3 of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications, or Section A2.3 of AISI-NASPEC, verification of ductility shall be included.

6.2.1 **For steel specified as complying with one of the steel specifications noted in Section A3.1 of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications; or Section A2.1 of AISI-NASPEC, test data for each incoming steel coil from steel mills or steel service centers shall be in the form of mill certificates, independent laboratory tests or in-house testing with calibrated test equipment.**

6.2.2 **For steel permitted under Sections A3.2 and A3.3 of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications; or Sections A2.2 and A2.3 of AISI-NASPEC, test data for each incoming steel coil shall be from independent laboratory tests or in-house testing with calibrated test equipment. Calibration certificates shall indicate traceability to national standards of measurement. The manufacturer shall have an established program for the calibration and verification of its measuring and test equipment.**

6.3 **Records of all mill certificates, independent laboratory tests and in-house tests shall be retained by the manufacturer for a minimum of one year.**

6.4 **Periodic Measurements:**

6.4.1 **Periodic measurements of material base metal thickness (uncoated) are not required for steel coils that have mill certificates. Method of verification of the base metal thickness of the master coils that have mill certificates shall be detailed in the quality control manual.**

6.4.2 **Material without mill certification requires periodic measurement of material base metal thickness (uncoated). Measurements of material shall be performed with calibrated equipment, either in-house or by an independent laboratory.**

6.4.2.1 **Test specimens for periodic testing shall consist of one out of every 250 pieces for nonbearing studs and tracks and one out of every 100 pieces for bearing studs and joists.**

6.4.2.2 **Alternative specimen testing for the material thickness can be accomplished by measuring each final coil at a minimum of one measurement per 2,000 linear feet (610 m) for nonbearing studs and tracks and one measurement per 800 linear feet (245 m) for bearing studs and joists.**

6.4.2.3 **Another alternative is to measure each final coil at three locations: the beginning, the end, and at midpoint. Final coil is defined as the steel coil that has been slit into its final width prior to roll forming into a product without additional slitting.**

6.4.3 **Measurement may be of the total material thickness, including coating, provided complete details covering the methods of determining uncoated steel thickness are included in the quality control manual.**

6.4.4 **Description of test method shall be documented in the quality control manual. Measurements shall be of the uncoated base metal.**
6.5 Additional quality control testing may be necessary as determined by ICC-ES when method No. 1, full section tensile tests, or No. 2, stub column tests, as defined in Section A5.2.2 (a) of the 1986 ASD Specifications and 1991 LRFD Specifications, and Section A7.2 (a) of the 1996 Specifications and AISI-NASPEC is used for strength increase from cold work of forming.

6.6 Quality control tests shall be conducted in accordance with the following:

6.6.1 Yield strength—ASTM A 370.

6.6.2 Tensile strength—ASTM A 370.

6.6.3 Ductility—Section A3.3 of the 1986 ASD Specifications, 1991 LRFD Specifications and 1996 Specifications and Section A2.3 of AISI-NASPEC.

6.6.4 Elongation—Section A3.3 of the 1986 ASD Specifications, 1991 LRFD Specifications and 1996 Specifications and Section A2.3 of AISI-NASPEC.

6.6.5 Coating—Zinc coating hot-dip process—ASTM A 924, Section 7.1.4. Other coatings are acceptable provided coatings comply with national standards.

6.7 Minimum conditions of acceptance for each test shall be specified in the in-house quality control manual for each specified steel. In addition to the tests listed in Section 6.1, the manual shall include the following:

6.7.1 Minimum yield strength used in design, or minimum yield stress prior to yield strength increase due to cold work of forming, if applicable.

6.7.2 Minimum base steel thickness (uncoated) allowed for each thickness recognized in an evaluation report. Minimum bare steel thickness shall not be less than 95 percent of the design thickness.
TABLE 1—TYPICAL BASE-METAL THICKNESSES

| DESIGN THICKNESS^4 | [3] |
1. Allowable axial load of perforated wall studs:

The effective area $A_e$ at stress $F_n$ can be determined by a rational analysis assuming the web to consist of two unstiffened strips, one each side of the perforation. For axial loading, the strips are treated as uniformly compressed unstiffened elements using Section (B3.1) of the 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications. The approach has the following limitations:

a. Web perforations shall have center-to-center spacing of not less than 24 inches (610 mm).
b. Web perforation maximum width shall be the lesser of 0.5 times the stud depth, $d$, 2\(\frac{1}{2}\) inches (63.5 mm).
c. Web perforation length shall not exceed $4\frac{1}{2}$ inches (114 mm).
d. Minimum distance between the end of the stud and the near edge of the web perforation shall be 10 inches (254 mm).
e. The section depth-to-thickness ratio, $d/t$, shall not be less than 20.

2. Flexural load-carrying capacity of perforated stud members:

a. Bending—Major Axis:

$$M_o = 0.6 S_e F_y$$

This assumes lateral torsional buckling is precluded.

- $S_e$ = Effective section modulus based on an unpunched web as defined in Section [C3.1.1(a)] of the 1986 ASD Specifications, 1991 LRFD Specifications and 1996 Specifications.
- $F_y$ = Design yield stress as determined in Section (A5.2.1) of the 1986 ASD Specifications and 1991 LRFD Specifications.

Minor Axis—Procedure is similar to determination of $A_e$ for members subjected to axial compression.

b. Shear—Allowable shear can be estimated by applying the reduction factor, $q_s$, to the design values of Section (C3.2) of the 1986 ASD Specifications, 1991 LRFD Specifications and 1996 Specifications. An unpunched web should be assumed for the equations in Section (C3.2) of the 1986 ASD Specifications, 1991 LRFD Specifications and 1996 Specifications.

$$q_s = 1.0 - 1.1 \left( \frac{a'}{D} \right)$$

- $a'$ = Depth of the opening (perforation).
- $D$ = Overall depth of the web.

c. Web Crippling—The following items must be considered:

(1) If the edge of the web opening is at least equal to 1.5D from the edge of the bearing, no reduction in the web crippling allowable strength is required. Analysis should be based on Section (C3.4) of the 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications.

(2) If the edge of the web opening is less than 1.5D from the edge of the bearing, the allowable code web crippling shall be reduced by using the following factor:

$$R = [1.0 - 0.197 (a'/D)] \times [1.0 - 0.127 (b/n_1)]$$

The equation is applicable for members having $b/n_1$ less than 2.0.

- $n_1 = N + (D - 2t - a')$.
- $b$ = Length of web opening.
- $N$ = Actual length of bearing.
- $t$ = Base steel thickness.
Other variables are defined in Item 2b.

(3) If the web opening is located within the bearing length, web stiffeners must be used.

d. Combined Bending and Shear—Design Equation (C3.3-1) of Section (C3.3) of the 1986 ASD Specifications and 1991 LRFD Specifications, and Equation (C3.3.1-1) or (C3.3.2-1) of Section C3.3 of the 1996 Specifications is applicable with modifications to the allowable shear and moment described above.

e. Combined Bending and Web Crippling—Design Equations in Section (C3.5) of the 1986 ASD Specifications. 1991 LRFD Specifications and 1996 Specifications are applicable with modifications to allowable concentrated load and moment as described above.

f. The flexural load-carrying capacity of perforated stud members is subject to the web perforation limitations noted in Sections 1a, b, c, d and e of Appendix A of this criteria.

Deleted: B
APPENDIX B

Structural Properties

<table>
<thead>
<tr>
<th>MEMBER SIZE (inches) OR DESIGNATION</th>
<th>DESIGN THICKNESS (inches)</th>
<th>WEIGHT (lbs./ft.)</th>
<th>GROSS SECTION PROPERTIES</th>
<th>EFFECTIVE SECTION PROPERTIES*</th>
<th>ALLOWABLE MOMENT Ma (in.-lbs.)*</th>
<th>TORSIONAL SECTION PROPERTIES**</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 lb./ft. = 1.489 kg/m, 1 in. - lb. = 11.30 N · m.

Notes:

The extreme fiber stress of the flexural members used in design shall be noted in the structural properties tables. This stress shall be the yield stress of the base metal.

In addition, if applicable, the following statement shall be noted in the table: “Effective properties and allowable moment incorporate stress increase as a result of cold work of forming, where applicable.”

Definitions:

*Effective section properties are the properties determined from the total effective width of each element of the member and used in the design of the member in accordance with AISI-NASPEC for recognition under the IBC and UBC Chapter 22, Divisions VI or VII, of the UBC, or AISI 1996 specifications for recognition under the UBC.

1. Effective \( I_x \) is based on Procedure I of Section C3.1.1 of the 1986 ASD Specifications, 1991 LRFD Specifications and 1996 Specifications for recognition under the UBC for deflection determination at the allowable moment.

2. Effective area is the area based on using \( f = F_y \) in equation B2.1-4. (Optional.)

**Torsional section properties are optional for nonaxial load-bearing members.
Comments on SSMA Recommended Changes to AC46

Section 1.0: Introduction

This has been updated to reflect the 2006 International Building Code and International Residential Code.

Section 1.2: Scope

The sentence, “This acceptance criteria is applicable to framing members connected together with steel screws, welds or bolts” has been deleted. It restricts members that may be clinched, riveted, or otherwise connected using alternative methods. By deleting this sentence, the Acceptance Criteria will become less restrictive, and be able to encompass more assemblies, such as boxed headers that are clinched or riveted together, as long as the clinch or rivet has its own Acceptance Criteria.

Section 1.3: Codes and Reference Standards

This has been updated to reference the 2006 International codes, as well as the AISI documents referenced in the 2006 International Building Code and International Residential Code.

Although not reflected in the attached markups, the SSMA recommends that the North American Specification for the Design of Cold-Formed Steel Structural Members and its 2004 supplement be referenced together, as is done in the 2006 International Building Code (see below.)

Section 1.4: Definitions

The definitions quoted directly from the International Building Code should be deleted. The definition of “curtain wall” that was listed, did not match the definition shown in the Standard for Cold-Formed Steel Framing – Wall Stud Design – a referenced standard. Since “load-bearing wall” and “nonload-bearing wall” are already defined in the code, it would make more sense to define “Structural Member” and “Nonstructural member.” However, since the definitions in the General Provisions Standard do not add any clarity (a member could conceivably be both a structural member and nonstructural member under those definitions,) it would be more appropriate including the following definitions from ASTM Standards:

- From ASTM C 645-04 (referenced in chapter 25 of the 2006 IBC, and section R702 of the 2006 IRC):
  - nonstructural wall stud, n—a member in a steel framed wall system which is limited to a lateral (transverse) load of not more than 10 lb/ft2(480 Pa), a superimposed vertical load, exclusive of sheathing materials, of not more than 100 lb/ft (1460 N/m), or a superimposed vertical load of not more than 200 lbs (890 N).
• From ASTM C 955-03 (referenced in chapter 25 of the 2006 IBC, and section R702 of the 2006 IRC):
  o structural member, n—a member in a steel framed system in which the loading exceeds any of the following conditions: a transverse load of 20 lbf/ft (290 N/m) of member length, or an axial load, exclusive of sheathing, of 200 lbf (890 N) per member.

Rationale for the inclusion of the definitions from C 645 and C 955 is that currently, “nonstructural” is used in section 3.1.1 of the Acceptance Criteria and “structural” is used in Table 1. In addition, the title of one of the referenced documents is the “North American Specification for the Design of Cold-Formed Steel Structural Members.” Clarification of structural versus nonstructural would therefore be helpful.

If staff still feels that a definition for “curtain wall” is required, since it is used in several current and legacy reports, the definition should be the one that is in a currently referenced standard; or better yet, the improved definition from the updated General Provisions Standard (2005 draft):
• From the AISI Standard for Cold-Formed Steel Framing – Wall Stud Design (referenced in chapter 22 of the 2006 IBC), with the addition of the phrase “out of plane:”
  o curtain wall, n—a wall that transfers transverse (out of plane) loads and is limited to a superimposed vertical load, exclusive of sheathing materials, of not more than 100 lb/ft or a superimposed vertical load of not more than 200 lbs.

As a reference, the following definitions should be considered, but not added, since they are not part of a standard currently referenced by the building code:
• From the revised General Provisions Standard (change balloted and accepted, 2005):
  o **Non-Structural Member.** A member in a steel framed system which is limited to a transverse (out-of-plane) load of not more than 10 lb/ft² (0.48 kPa), a superimposed axial load, exclusive of sheathing materials, of not more than 100 lb/ft (1.46 kN/m), or a superimposed axial load of not more than 200 lbs (0.89 kN).
  o **Structural Member.** A member that resists design loads [factored loads], as required by the applicable building code, except when defined as a non-structural member.

Section 3.1.1: Material Specifications:

Update the referenced standard for the IBC to the 2004 General Provisions. Note that the IRC does not directly reference the General Provisions standard; however it is referenced by each of the three standards listed in the IRC, so it is appropriate leaving the IBC and IRC reference to the General Provisions.
In the last sentence of section 3.1.1, 5 psf should be changed to 10 psf, for the following reasons:

1. The only place where this 5 psf limit appears for nonstructural members is in the 2004 General Provisions Standard.
2. The latest draft of the General Provisions Standard has corrected this error; based on 2005 balloting through the ANSI consensus process, it now reads 10 psf as the limit for nonstructural members.
3. ASTM C 645-04 (referenced in chapter 25 of the 2006 IBC, and section R702 of the 2006 IRC), defines a nonstructural wall stud as one that can carry pressures up to 10 psf. There are axial load limits as well.
4. ASTM C 955-03 (referenced in chapter 25 of the 2006 IBC, and section R702 of the 2006 IRC), defines a structural member as one whose transverse load is greater than or equal to 20 pounds per foot. This is equivalent to the 10 pounds per square foot load when studs are spaced at two feet on-center.
5. The General Provisions definition that gives the 5 psf limit, “non-structural stud,” is not clear when taken in the context of the other General Provisions definitions. As was demonstrated in the industry meeting on July 12, a single member in an interior wall carrying a 90 plf load could be classified as a “structural member,” a “structural stud,” and a “non-structural stud.”
6. In its scope statement, General Provisions states, “these General Provisions shall not preclude the use of other materials, assemblies, structures, or designs not meeting the criteria herein, when the other materials, assemblies, structures, or designs demonstrate equivalent performance for the intended use to those specified in these General Provisions.” Evaluation Report developers should be given the opportunity to “demonstrate equivalent performance,” rather than being restricted to 5 psf by this section of the Acceptance Criteria.
7. Where the General Provisions Standard is referenced by the Prescriptive Method, latitude is permitted in interpretation:

In section A1, Scope, of the Prescriptive Method:

Buildings complying with the limitations herein, shall be constructed in accordance with this Prescriptive Method and the Standard For Cold-Formed Steel Framing-General Provisions (General Provisions). Alternatively such dwellings are permitted to be designed by a Design Professional. Where there is a conflict between the Prescriptive Method and other reference documents the requirements of the Prescriptive Method shall govern.

A4.1 General

Structural and non-structural framing members shall comply with the General Provisions and the additional limitations of this section. Such limitations shall not apply where design is provided by a Design Professional.

For the reasons stated above, it could be argued that the last sentence of 3.1.1 should be removed altogether, since equivalent performance and engineered designs are permitted by General Provisions and the Prescriptive Method. However, for now the SSMA and our industry partners would be willing to accept the 10 psf limit, based on the ASTM references, as well as the latest draft of the General Provisions standard.

Section 3.1.2: Thickness:

The reference to Appendix A and table 1 has been deleted, as has Appendix A in its entirety. Since the General Provisions standard permits alternative thicknesses, the criteria should not be limited to the thicknesses given in the appendix table. This will help simplify the criteria, and facilitate the
development of reports; especially if report holders want to use intermediate thicknesses not found in the table.

**Section 3.1.3: Protective Coating:**

The words, “or equivalent” have been added after the G40 coating. Note that in ASTM C 645, section 4.2 states, “Members shall have a protective coating conforming to Specification A 653/A 653M – G 40 minimum or shall have a protective coating with an equivalent corrosion resistance.”

**Section 3.2: Cold-Formed Steel Framing Members:**

A large portion of this section has been deleted, since it repeated code language from the 2004 Supplement to the *North American Specification for the Design of Cold-Formed Steel Structural Members* (hereafter referred to as the *Specification*.) See specifics under 3.2.1 and 3.2.2 below.

**Section 3.2.1: Section Properties.**

Since Appendix A and Table 1 has been deleted, SSMA felt that this would be an appropriate place to restate the requirements that the minimum delivered thickness may not be less than 95 percent of the design thickness.

**Section 3.2.2 through section 3.2.7:**

The paragraphs that reference each of the buckling modes and failure modes for members may be replaced by the summary sentence that follows each of these paragraphs in the current Acceptance Criteria: “For members that exceed limitations specified in the applicable specifications or do not conform to the requirements of applicable specifications, full-scale tests are necessary to determine applicable strength. See Section 4.2 (4.3 for web crippling) of this criteria.” If staff prefers, they could spell out the failure modes before this sentence. An example of an appropriate rewrite of this entire set of sections:

> Members shall be analyzed in accordance with the appropriate code-referenced standards in accordance with section 1.1. Provisions from these standards may be used to determine deflection, and strength due to web crippling, bending, shear, compression, tension, and specified combinations of these loads. For members that exceed limitations specified in the applicable specifications or do not conform to the requirements of applicable specifications, full-scale tests are necessary to determine applicable strength. See Section 4.2 (4.3 for web crippling) of this criteria.

**Section 4.2: Testing Methods:**

There are many types of member modifications; therefore the phrase, “such as web perforations” has been deleted, since it adds no clarity to the document.

For the reasons discussed in the meeting, testing should be permitted in accordance with chapter F in its entirety, rather than just section F1. Therefore, “F1” has been changed to “F” in the first sentence.
A mechanism needs to exist to allow cold-formed steel members to be tested even if they do not have modifications or even if they do not exceed the limitations in the NASPEC. This is because even if a member can have its properties (strength and stiffness) calculated in accordance with the code, it should not necessarily preclude testing to determine properties. A specific example would be hat-shaped members with complex lips. Some of these configurations in multi-span configurations with uniform load exhibit much greater capacities than what is found by calculating their span and capacity using the Specification. Therefore, verbiage has been added to permit testing in accordance with chapter F, in accordance with section 1.1(a) of NASPEC.

Rate of loading: because loading rates are subjective, and dependent upon the stiffness of the material being tested, limits on loading rates should not be incorporated into these Criteria. Rather, the sentence on loading rates should be deleted, and SSMA has added “rate of loading” to the reporting requirements for the test program submittal. Preliminary testing may need to be accomplished to determine what this rate will be for specific configurations and material samples.

Section 5.0: Field Identification

There are already requirements for field identification in the following referenced standards:

- General Provisions
- ASTM C 645
- ASTM C 955
- ASTM A 1003
- International Residential Code

SSMA suggests that the Acceptance Criteria require marking in accordance with the applicable codes. In addition, marking should include the evaluation report number (ESR-XXXX); the acronym “ICC-ES”, and if members are field-manufactured, the inspection agency name or logo and manufacturing equipment serial number.

Note that current (2006) versions of ASTM C645 and C955 show marking spacing at 96” on center, rather than 48” on center. The current draft of the General Provisions standard reflects the 96” spacing as well. SSMA recommends that the ICC ES marking, as well as the evaluation report number and marking for field-manufactured members be required at 96” on center in the Acceptance Criteria, to match these latest requirements.

Appendix A: Typical Base Metal Thickness [deleted]

From section 3.1.2: The reference to Appendix A and table 1 has been deleted, as has Appendix A in its entirety. Since the General Provisions standard permits alternative thicknesses, the criteria should not be limited to the thicknesses given in the appendix table. This will help simplify the criteria, and facilitate the development of reports; especially if report holders want to use intermediate thicknesses not found in the table.

Subsequent appendices: re-alphabetized.
Structural and Nonstructural Members

This reference shows information from the following documents:

- 2005 Approved Draft of the Standard for Cold-Formed Steel Framing - General Provisions
- 2006 International Building Code
- ASTM C 645, Standard Specification for Nonstructural Steel Framing Members
- ASTM C 955, Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
- ASTM A 1003, Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members

Changed definitions made to the General Provisions Standard since the 2004 edition, dealing with the structural/nonstructural issue:

**Non-Structural Stud.** A member in a steel framed wall system which is limited to a lateral (transverse) load of not more than 5 lb/ft² (240 Pa), a superimposed vertical load, exclusive of sheathing materials, of not more than 100 lb/ft (1460 N/m), or a superimposed vertical load of not more than 200 lbs (890 N). [Ballot MC-SC 05-02A (GP)]

**Non-Structural Member.** A member in a steel framed system which is limited to a transverse (out-of-plane) load of not more than 10 lb/ft² (480 Pa) (0.48 kPa), a superimposed axial load, exclusive of sheathing materials, of not more than 100 lb/ft (1460 N/m) (1.46 kN/m), or a superimposed axial load of not more than 200 lbs (890 N) (0.89 kN). [Ballot MC-SC 05-02A (GP)]

**Non-Structural Wall.** A steel framed wall system which is limited to a lateral (transverse) load of not more than 5 lb/ft² (240 Pa), a superimposed vertical load, exclusive of sheathing materials, of not more than 100 lb/ft (1460 N/m), or a superimposed vertical load of not more than 200 lbs (890 N). [Stud-2004]

**Structural Member.** A floor joist, rim track, structural stud, wall track in a structural wall, ceiling joist, roof rafter, header, or other member that is designed or intended to carry loads. [GP-2004]

**Structural Member.** A member that resists design loads [factored loads], as required by the applicable building code, except when defined as a non-structural member. [Ballot MC-SC 05-02A (GP)]

**Curtain Wall.** A wall that transfers lateral (transverse) (out of plane) loads and is limited to a superimposed vertical load, exclusive of sheathing materials, of not more than 100 lb/ft (1460 N/m) (1.46 kN/m), or a superimposed vertical load of not more than 200 lbs (890 N) (0.890 kN). [Stud-2004]
Two examples of how the term *structural member* is used in the **General Provisions Standard**:

**B2.2.1 Cutting and Patching**

All cutting of framing members shall be done by sawing, abrasive cutting, shearing, plasma cutting or other approved methods. Cutting or notching of *structural members*, including flanges and lips of joists, studs, headers, rafters, and ceiling joists, or the patching of those cuts shall not be permitted without an approved design or in accordance with a recognized design standard.

**B2.2.2 Splicing**

Splicing of joists, studs and other *structural members* shall not be performed without an approved splice design or in accordance with a recognized design standard.

Structural member is also used in several of the definitions in the General Provisions Standard.

From the **2006 International Building Code**, the following definitions appear on page 20, chapter 2:

**WALL, LOAD-BEARING.** Any wall meeting either of the following classifications:

1. Any metal or wood stud wall that supports more than 100 pounds per linear foot (1459 N/m) of vertical load in addition to its own weight.
2. Any masonry or concrete wall that supports more than 200 pounds per linear foot (2919 N/m) of vertical load in addition to its own weight.

**WALL, NONLOAD-BEARING.** Any wall that is not a load-bearing wall.
Definitions from **ASTM C645**: Standard Specification for Nonstructural Steel Framing Members

3.2 Definitions of Terms Specific to This Standard:
3.2.1 members, n—in screw application of gypsum board, studs, runners (track), hat furring channels, main beams and cross furring members of grid suspension systems or other items manufactured in accordance with this specification.

3.2.2 nonstructural wall stud, n—a member in a steel framed wall system which is limited to a lateral (transverse) load of not more than 10 lb/ft² (480 Pa), a superimposed vertical load, exclusive of sheathing materials, of not more than 100 lb/ft² (1460 N/m), or a superimposed vertical load of not more than 200 lbs (890 N).

The only place in C645 that the term “nonstructural” appears other than the title of the document is the scope statement:

1. Scope*

   1.1 This specification covers nonstructural steel framing members in interior construction assemblies.

* A Summary of Changes section appears at the end of this standard.

Definitions from **ASTM C955**: Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases

3.2 Definitions of Terms Specific to This Standard:
3.2.1 members, n—studs, runners, tracks, bracing, bridging, accessories or other items manufactured in accordance with this standard.

3.2.2 structural member, n—a member in a steel framed system in which the loading exceeds any of the following conditions: a transverse load of 20 lb/ft² (290 N/m) of member length, or an axial load, exclusive of sheathing, of 200 lb (890 N) per member.

4. Materials and Manufacture

4.1 Members shall be manufactured from steel meeting the requirements of Specification A 1003/A 1003M.

4.2 The minimum steel thickness (base steel) shall be not less than 0.0329 in. (0.84 mm).

Note that section 4 of ASTM C 955, as well as the scope statement, limits the applicability of this section to members with thicknesses of not less than 0.0329 inches. Both C 645 and C 955 reference ASTM A 1003, which does not differentiate between structural and nonstructural members. It does, however, reference the types of steel that can be used for framing in table 1 (shown on next page.)

Note: this 20 lb/ft is equivalent to 10 psf with studs spaced at 2 feet on center.
ASTM A 1003/A 1003M – 02a: Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members

1. Scope

1.1 This specification covers coated steel sheet used in the manufacture of cold-formed framing members, such as, but not limited to, studs, joists, purlins, girts, and track.

1.2 The steel sheet used for cold-formed framing members includes metallic-coated, painted metallic-coated, or painted nonmetallic-coated.

Note in table 2, one grade of 33 ksi nonstructural material is permitted. A 1003 does not state whether or not these steels can be used for C 645 or C 955 steel framing members; it just gives the qualities for the sheet steel that the manufacturer can order to roll members in accordance with C 645 and C 955. Table 1 gives the required coating for materials: G60 or equivalent for structural, and G40 or equivalent for nonstructural.

<table>
<thead>
<tr>
<th>TABLE 2 Mechanical Properties, Base Metal</th>
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<tbody>
<tr>
<td><strong>Designation</strong></td>
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<tr>
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<tr>
<td>ST40H [ST275H]</td>
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<tr>
<td>ST37H [ST255H]</td>
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<tr>
<td>ST33H [ST235H]</td>
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<tr>
<td>ST50L [ST340L]</td>
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<td>ST40L [ST275L]</td>
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<td>ST37L [ST255L]</td>
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<tr>
<td>ST33L [ST235L]</td>
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<td>NS 33</td>
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</table>

Note 1—All values are minimum requirements in the longitudinal direction.

<table>
<thead>
<tr>
<th>TABLE 1 Coating Weight [Mass] Requirements (Metallic Coatings)</th>
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</thead>
<tbody>
<tr>
<td><strong>Product Designation</strong></td>
</tr>
</tbody>
</table>

A Zinc-coated steel sheet as described in Specification A 653/A 653M.
B Zinc-iron alloy-coated steel sheet as described in Specification A 653/A 653M.
C 55% aluminum-zinc alloy-coated as described in Specification A 792/A 792M.
D Zinc-5% aluminum alloy-coated steel sheet as described in Specification A 875/A 875M.
E Aluminum-coated Type 1 and Type 2 steel sheet as described in Specification A 483/A 483M.
F Zinc-coated steel sheet as described in Specification A 879

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nde: 4 of 4: Structural Member References
ICC EVALUATION SERVICE, INC.,
RULES OF PROCEDURE FOR THE EVALUATION COMMITTEE

1.0 PURPOSE
The purpose of the Evaluation Committee is to monitor the work of ICC-ES, in issuing evaluation reports; to evaluate and approve acceptance criteria on which evaluation reports may be based; and to sponsor related changes in the applicable codes.

2.0 MEETINGS
2.1 The Evaluation Committee shall schedule meetings that are open to the public in discharging its duties under Section 1, subject to Section 3.

2.2 All scheduled meetings shall be publicly announced.

2.3 Two-thirds (2/3) of the voting Evaluation Committee members shall constitute a quorum. A majority vote of members present is required on any action.

2.4 In the absence of the nonvoting chairman-moderator, Evaluation Committee members present shall elect an alternate chairman from the committee for that meeting. The alternate chairman shall be counted as a voting committee member for purposes of maintaining a committee quorum and to cast a tie-breaking vote of the committee.

2.5 Minutes of the meetings shall be kept.

2.6 An electronic audio record of meetings shall be made by ICC-ES; no other audio, video, electronic or stenographic recordings of the meetings will be permitted. Visual aids (including, but not limited to, charts, overhead transparencies, slides, videos, or presentation software) viewed at meetings shall be permitted only if the presenter provides ICC-ES before presentation with a copy of the visual aid in a medium which can be retained by ICC-ES with its record of the meeting and which can also be provided to interested parties requesting a copy. A copy of the ICC-ES recording of the meeting and such visual aids, if any, will be available to interested parties upon written request made to ICC-ES together with a payment as required by ICC-ES to cover costs of preparation and duplication of the copy. These materials will be available beginning five days after the conclusion of the meeting but will no longer be available after 30 days have elapsed from the conclusion of the meeting.

2.7 Parties interested in the deliberations of the committee should refrain from communicating, whether in writing or verbally, with committee members regarding agenda items. All written communications and submissions regarding agenda items should be delivered to ICC-ES. All such written communications and submissions shall be considered nonconfidential and available for discussion in open session of an Evaluation Committee meeting, and shall be delivered at least ten days before the scheduled Evaluation Committee meeting if they are to be forwarded to the committee. Correspondence received by ICC-ES will not be released to any party, except to the Evaluation Committee, prior to the meeting without permission of the author. The committee reserves the right to refuse recognition of communications which do not comply with the provisions of this section. All such communications and submissions will be available from ICC-ES upon written request and payment of costs associated with duplication. The materials will be available beginning five days after the conclusion of the meeting but will no longer be available after 30 days have elapsed from the conclusion of the meeting.

3.0 CLOSED SESSIONS
Evaluation Committee meetings shall be open except that the chairman may call for a closed session to seek advice of counsel.

4.0 ACCEPTANCE CRITERIA
4.1 Acceptance criteria are established by the committee to provide a basis for issuing ICC-ES evaluation reports on products and systems under codes referenced in Section 2.0 of the Rules of Procedure for Evaluation Reports. They also clarify conditions of acceptance for products and systems specifically regulated by the codes.

Acceptance criteria may involve a product, material, method of construction, or service. Consideration of any acceptance criteria must be in conjunction with a current and valid application for an ICC-ES evaluation report, an existing ICC-ES evaluation report, or as otherwise determined by the Evaluation Committee.

4.2 Procedure:

4.2.1 Proposed acceptance criteria shall be developed by the ICC-ES staff and discussed in open session with the Evaluation Committee during a scheduled meeting, except as permitted in Section 5.0 of these rules.

4.2.2 Proposed acceptance criteria shall be available to interested parties at least 30 days before discussion at the committee meeting.

4.2.3 The committee shall be informed of all pertinent written communications received by ICC-ES.

4.2.4 Attendees at Evaluation Committee meetings shall have the opportunity to speak on acceptance criteria listed on the meeting agenda, to provide information to committee members.

4.3 Approval of acceptance criteria shall be as specified in Section 2.3 of these rules.

4.4 The action of the Evaluation Committee may be appealed in accordance with the ICC-ES Rules of Procedure for Appeal of Acceptance Criteria.
5.0 COMMITTEE BALLOTING FOR ACCEPTANCE CRITERIA

5.1 Acceptance criteria may be issued without a public hearing following a 45-day public comment period and a majority vote for approval by the Evaluation Committee when, in the opinion of ICC-ES staff, one or more of the following conditions have been met:

1. The subject is nonstructural, does not involve life safety, and is addressed in nationally recognized standards or generally accepted industry standards.

2. The subject is a revision to an existing acceptance criteria that requires a formal action by the Evaluation Committee, and public comments raised were resolved by staff with commenters fully informed.

3. Other acceptance criteria and/or the code provide precedence for the revised criteria.

5.2 Negative votes must be based upon one or more of the following, for the ballots to be considered valid and require resolution:

a. Lack of clarity: There is insufficient explanation of the scope of the acceptance criteria or insufficient description of the intended use of the product or system; or the acceptance criteria is so unclear as to be unacceptable. (The areas where greater clarity is required must be specifically identified.)

b. Insufficiency: The criteria is insufficient for proper evaluation of the product or system. (The provisions of the criteria that are in question must be specifically identified.)

c. The subject of the acceptance criteria is not within the scope of the applicable codes: A report issued by ICC-ES is intended to provide a basis for approval under the codes. If the subject of the acceptance criteria is not regulated by the codes, there is no basis for issuing a report, or a criteria. (Specifics must be provided concerning the inapplicability of the code.)

d. The subject of the acceptance criteria needs to be discussed in a public hearing. The committee member requests additional input from other committee members, staff or industry.

5.3 An Evaluation Committee member, in voting on an acceptance criteria, may only cast the following ballots:

- Approved
- Approved with Comments
- Negative: Do Not Proceed

6.0 COMMITTEE COMMUNICATION

Direct communication between committee members, and between committee members and an applicant or concerned party, with regard to the processing of a particular acceptance criteria or evaluation report shall take place only in a public hearing of the Evaluation Committee. Accordingly:

6.1 Committee members receiving an electronic ballot should respond only to the sender (staff). Committee members who wish to discuss a particular matter with other committee members, before reaching a decision, should ballot accordingly and bring the matter to the attention of ICC-ES staff, so the issue can be placed on the agenda of a future committee meeting.

6.2 Committee members who are contacted by an applicant or concerned party on a particular matter that will be brought to the committee will refrain from private communication and will encourage the applicant or concerned party to forward their concerns through the ICC-ES staff in writing, and/or make their concerns known by addressing the committee at a public hearing, so that their concerns can receive the attention of all committee members.

Effective November 6, 2006
PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR COLD-FORMED STEEL FRAMING MEMBERS

AC46

Proposed December 2006


PREFACE

Evaluation reports issued by ICC Evaluation Service, Inc. (ICC-ES), are based upon performance features of the International family of codes and other widely adopted code families, including the Uniform Codes, the BOCA National Codes, and the SBCCI Standard Codes. Section 104.11 of the International Building Code® reads as follows:

The provisions of this code are not intended to prevent the installation of any materials or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

Similar provisions are contained in the Uniform Codes, the National Codes, and the Standard Codes.

ICC-ES may consider alternate criteria, provided the report applicant submits valid data demonstrating that the alternate criteria are at least equivalent to the criteria proposed in this document, and otherwise meet the applicable performance requirements of the codes. Notwithstanding that a product, material, or type or method of construction meets the requirements of the criteria proposed in this document, or that it can be demonstrated that valid alternate criteria are equivalent to the criteria in this document and otherwise meet the applicable performance requirements of the codes, ICC-ES retains the right to refuse to issue or renew an evaluation report, if the product, material, or type or method of construction is such that either unusual care with its installation or use must be exercised for satisfactory performance, or malfunctioning is apt to cause unreasonable property damage or personal injury or sickness relative to the benefits to be achieved by the use of the product, material, or type or method of construction.
1.0 INTRODUCTION

1.1 Purpose: The purpose of this criteria is to establish requirements for cold-formed steel framing members to be recognized in an ICC Evaluation Service, Inc. (ICC-ES), evaluation report under the 2003 2006 International Building Code® (IBC), the 2003 2006 International Residential Code® (IRC) and the 1997 Uniform Building Code™ (UBC). Basis of recognition under the IBC is the United States of America provisions of AISI-NASPEC and AISI/COFS/GP as referenced in IBC Sections 1604.3.3 and 2210. Bases of recognition under the IRC are IRC Sections R301.1.3, R505, R603, and R804. Basis of recognition under the UBC is UBC Chapter 22, Division VI or VII, or AISI 1996 Specifications.

The reason for the development of this criteria is to provide guidelines for the evaluation of cold-formed steel framing, to comply with the provisions and requirements of Chapter 22 of the IBC, Chapters 3, 5, 6 and 8 of the IRC, and Chapter 22 of the UBC to provide detailed requirements for a quality control system to be used in the manufacturing of steel framing members being used in the design and construction of cold-formed steel framing members.

1.2 Scope: This acceptance criteria applies to cold-formed steel framing members used in light-frame construction. This acceptance criteria is applicable to framing members connected together with steel screws, welds or bolts.

1.3 Codes and Referenced Standards:


1.3.3 1997 Uniform Building Code™ (UBC).


1.3.6 AISI/COFS/TRUSS 2000 2004, AISI Standard for Cold-Formed Steel Framing—Truss Design, American Iron and Steel Institute (AISI).

1.3.7 AISI/COFS/HEADER 2004 2004, AISI Standard for Cold-Formed Steel Framing—Header Design, American Iron and Steel Institute (AISI).

1.3.8 AISI/COFS/WALL STUD 2004, AISI Standard for Cold-Formed Steel Framing—Wall Stud Design, American Iron and Steel Institute (AISI).

1.3.9 AISI/COFS/LATERAL 2004, AISI Standard for Cold-Formed Steel Framing—Lateral Design, American Iron and Steel Institute (AISI).

1.3.10 Specification for Design of Cold-Formed Steel Structural Members, 1986 with December 1989 addendum, American Iron and Steel Institute (AISI) (referred to as 1986 ASD Specifications).

1.3.11 Load and Resistance Factor Design Specification for Cold-Formed Steel Structural Members, March 1991, American Iron and Steel Institute (AISI) (referred to as 1991 LRFD Specifications).


1.3.13 ASTM A 370-97a, Test Methods and Definitions for Mechanical Testing of Steel Products, ASTM International.


1.3.15 TS 9-05, Standard Test Method for Determining the Web Crippling Strength of Cold-Formed Steel Beams, American Iron and Steel Institute (AISI).

1.4 Definitions:

1.4.1 Load-bearing Wall: Any exterior or interior steel stud wall that supports more than 100 pounds per linear foot (1460 N/m) of superimposed vertical load (vertical load in addition to its own weight) and an out of plane lateral load.

1.4.2 Nonload-bearing Wall: Any interior steel stud wall that supports 100 pounds or less per linear foot (1460 N/m) of superimposed axial load, exclusive of sheathing material or a superimposed vertical load of not more than 200 pounds (890 N) per stud.

1.4.3 Curtain Wall: Any exterior steel stud wall that supports 100 pounds or less per linear foot (1460 N/m) of superimposed vertical load, exclusive of sheathing material or a superimposed vertical load of not more than 200 pounds (890 N) per stud, and out of plane lateral loads.

1.4.4 Structural Member, n—a member in a steel framed system in which the loading exceeds any of the following conditions; a transverse load of 20 lbf/ft (290 N/m) of member length, or an axial load, exclusive of sheathing, of 200 lbf (890 N) per member.

1.4.5 Nonstructural Wall Stud, n—a member in a steel framed system which is limited to a lateral (transverse) load of not more than 10 lbf/ft² (480 Pa), a superimposed vertical load, exclusive of sheathing materials, of not more than 100 lbf/ft (1460 N/m), or a superimposed vertical load of not more than 200 lbs (890 N).

2.0 GENERAL

The following information shall be submitted:

2.1 Data concerning material specifications; section properties; maximum allowable heights; maximum allowable spans and/or maximum allowable loads; and lateral, mechanical or material bracing requirements.

2.2 Method of field identification.

2.3 Quality control program.
PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR COLD-FORMED STEEL FRAMING MEMBERS

2.4 Data in support of an application for recognition only under the IRC shall verify compliance with Sections R505, R603 and R804 of the IRC and the requirements noted in this criteria except for Section 4.0.

2.5 Testing Laboratories: Testing laboratories shall comply with Section 2.0 of the ICC-ES Acceptance Criteria for Test Reports (AC85) and Section 4.2 of the ICC-ES Rules of Procedures for Evaluation Reports.

2.6 Test Reports: Test reports shall comply with AC85. Details describing the test configuration, test methods and test procedures, including load application rate, shall be identified in the test report.

3.0 TEST AND PERFORMANCE REQUIREMENTS

3.1 Material Specifications:

3.1.1 Steel: Steel specifications shall comply either with Section A.3 of the AISI 1986 ASD Specifications or AISI 1991 LRFD Specifications, as referenced in UBC Chapter 22, Division VII or VI, respectively; with Section A.3 of the 1996 Specifications, for the UBC; or with Section A3 of the AISI/COFS/GP-GP-2004, for the IBC and IRC. Nonstructural grades of steel shall be limited to interior nonload-bearing walls with lateral loads of 510 psf (240 480 Pa) or less.

3.1.2 Thickness: Minimum steel thicknesses shall comply with Section A3.4 of either the 1986 ASD Specifications; 1991 LRFD Specifications; 1996 Specifications; or with Section A2.4 of AISI-NASPEC, and which states that the steel thickness shall not be less than 95% of the design thickness. Thickness shall also comply with Section A5.1 of AISI/COFS/GP. Table 1 in Appendix A of this criteria indicates cold formed steel framing thicknesses. Other thicknesses may be considered, provided substantiating data showing compliance with the applicable code and this criteria are submitted.

If the uncoated base metal thickness of cold formed steel framing members delivered to the jobsite corresponds to the minimum thickness noted in Table 1, the maximum design thickness of the members shall be the design thickness noted in the table.

3.1.3 Protective Coating: For use with the IBC and IRC, a minimum of G60 (or equivalent) is required for all applications with the exception of minimum G40 (or equivalent) for interior nonload-bearing walls with lateral loads of 5 psf or less.

3.1.4 Connections (Optional):

3.1.4.1 Screw Connection:

3.1.4.1.1 Member Capacity: The shear and pullout resistance of steel-to-steel connections with screws shall be determined in accordance with Section E4 of either the 1996 Specifications for use under the UBC; or with AISI-NASPEC and Section D1.1 of AISI/COFS/GP for use under the IBC.

3.1.4.1.2 Screw Capacity: Tapping screws shall be recognized in an evaluation report based on evaluation of the tapping screws for compliance with AC118 as modified by AISI/COFS/NASPEC-SUP04.

3.1.4.2 Welding: The shear and transverse resistance of the welded connection shall be determined in accordance with Sections E2.4 and E2.5 of either the 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications for use under the UBC; or with AISI NASPEC and Section D2 of AISI/COFS/GP for use under the IBC.

3.1.4.3 Bolted Connection: The strength of bolted connections shall be determined in accordance with Section E3 of either the 1996 Specifications for use under the UBC; or with AISI-NASPEC with Appendix A of the AISI NASPEC for use under the IBC.

3.2 Cold-formed Steel Framing Members: Evaluation reports on cold-formed steel framing members shall address the section properties and design approach as applicable.

3.2.1 Section Properties: Section properties shall be determined in accordance with AISI-NASPEC with AISI/COFS/NASPEC-SUP04 for recognition under the IBC; and 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications for recognition under the UBC. Structural properties data for steel members shall include the minimum information noted in Appendix C of this criteria. Information on additional properties is optional and can be furnished.

3.2.2 Web Crippling: Web crippling values for studs, joists and headers shall be determined in accordance with Section C2.4 of AISI-NASPEC with AISI/COFS/NASPEC-SUP04 for recognition under the IBC; and Section C2.4 of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications for recognition under the UBC. For members that exceed limitations specified in the applicable specifications or do not conform to the requirements of applicable specifications, full-scale tests are necessary to determine applicable end reactions and interior reactions. See Section 4.3 of this criteria.

3.2.3 Bending: Moment values and bending stiffness for members shall be determined in accordance with Section C2.1 of AISI-NASPEC with Appendix A and AISI/COFS/NASPEC-SUP04 for recognition under the IBC; and Section C2.1 of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications for recognition under the UBC. For members that exceed limitations specified in the applicable specifications or do not conform to the requirements of applicable specifications, full-scale tests are necessary to determine applicable flexural strength and stiffness. See Section 4.2 of this criteria.

3.2.4 Shear: Shear values for members shall be determined in accordance with Section C3.2 of AISI-NASPEC with AISI/COFS/NASPEC-SUP04 for recognition under the IBC; and Section C3.2 of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications for recognition under the UBC. For members that exceed limitations specified in the applicable specifications or do not conform to the requirements of applicable specifications, full-scale tests are necessary to determine applicable shear strength. See Section 4.2 of this criteria.

3.2.5 Combined Bending and Shear: Combined bending and shear values for members shall be determined in accordance with Section C3.3 of AISI-NASPEC with AISI/COFS/NASPEC-SUP04 for recognition under the IBC; and Section C3.3 of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications for recognition under the UBC. For members that exceed limitations specified in the applicable specifications or that do not conform to the requirements of applicable specifications, full-scale tests are necessary to determine applicable shear strength. See Section 4.2 of this criteria.
combined bending and shear strength. See Section 4.2 of this criteria:

3.2.6 Combined Bending and Web Crippling: Combined bending and web crippling values for members shall be determined in accordance with Section C3.5 of AISI-NASPEC with AISI/COS/NASPEC SUP04 for recognition under the IBC; and Section C3.5 of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications for recognition under the UBC. For members that exceed limitations specified in the applicable specifications or do not conform to the requirements of applicable specifications, full-scale tests are necessary to determine applicable combined bending and web crippling strength. See Section 4.2 of this criteria.

3.2.7 Axial Loads: Axial load capacity of members shall be determined in accordance with Section C2 and C4 of AISI-NASPEC with AISI/COS/NASPEC SUP04 for recognition under the IBC; and Sections C2 and C4 of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications for recognition under the UBC. For members that exceed limitations specified in the applicable specifications or do not conform to the requirements of applicable specifications, full-scale tests are necessary to determine applicable axial load strength. See Section 4.2 (4.3 for web crippling) of this criteria.

4.0 DESIGN AND TESTING METHODS

4.1 Design Methods: This section is for cold-formed steel members that can be designed in accordance with Section C of AISI-NASPEC with AISI/COS/NASPEC SUP04 for recognition under the IBC; and Section C of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications for recognition under the UBC.

Data concerning section properties, maximum allowable heights, spans and/or loads shall be submitted showing compliance with AISI-NASPEC for recognition under the IBC; and UBC Chapter 22, Division VI or VII, or 1996 Specification, for recognition under the UBC. The analytical approach noted in Appendix B of this criteria can be used as a supplement to UBC Chapter 22, Division VI or VII, or 1996 Specification when appropriate.

4.2 Testing Methods: For members with modifications such as web perforations, or members that exceed limitations in Section C3 and C4 of AISI-NASPEC used under the IBC and Section C3 and C4 of the 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications used under the UBC, testing shall be conducted in accordance with Section F4 of the AISI-NASPEC used under the IBC and of the 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications used under the UBC, except for web crippling. Web crippling shall be tested in accordance with Section 4.3 below. Alternatively, under the IBC and IRC, design strength [allowable design strength] and stiffness may be determined by rational analysis based on appropriate theory and engineering judgment when supported by applicable test data. Specifically, design strength [allowable design strength] shall be determined from calculated nominal strength [resistance] by applying the resistance factors [factors of safety] of Section A1.1(b) of the ANSI NASPEC, or in accordance with Section A1.1(a) of the NASPEC. Test data shall demonstrate that strength and stiffness are not less than the nominal strength and stiffness predicted by the analysis.

Testing programs under Section 4.2 of this criteria shall be submitted to the ES staff for review and acceptance prior to any testing being performed. The number of test specimens and test procedures and rate of loading shall be included in the test program submittal. If no rate of load is specified, the load rate used shall be reported and shall not exceed a corresponding applied stress rate of 3 ksi (20.7 MPa) of gross cross-sectional area per minute.

4.3 Web Crippling Tests:

4.3.1 Testing shall be conducted in accordance with AISI TS-9 on three similar specimens. Two series are required for each assembly: one series for interior reactions and a second series for end reactions. The load rate used under AISI TS-9 shall be reported. Both end reactions and interior reactions shall be evaluated in accordance with the conditions set forth in the applicable specification. The tested bearing width will be the minimum width recognized in the evaluation report. For member profiles available in multiple thicknesses, only the least thickness in each profile is required to be tested.

4.3.2 Conditions of Acceptance: The members shall be loaded to failure or dysfunctional distortions and the loads causing web crippling shall be recorded. The determination of nominal resistance, \( R_n \), shall be based on Sections F1 of AISI-NASPEC used under the IBC and Sections F1 of the 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications used under the UBC. For ASD, the allowable design strength, \( R_{ad} \), is as follows:

\[
R_{ad} = R_n / \Omega.
\]

where:

\[
\Omega = \frac{1.6}{\phi}
\]

For LRFD, equation F1.1-1 of AISI-NASPEC applies under the IBC, and equation F1-1 in the 1991 LRFD Specifications or equation F1.1-1 in the 1996 Specifications applies under the UBC.

The results shall be compared to the design equations in Section C3.4 of AISI-NASPEC for use under the IBC, and Section C3.4 of the 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications for use under the UBC. The lowest result, from either testing or calculations, will determine the allowable value noted in the evaluation report. Where design capacities are derived from testing, the value will apply to heavier thicknesses. If the calculated web crippling value is the lowest value, web crippling capacities for heavier thicknesses are permitted to be calculated in accordance with the applicable specification.

5.0 FIELD IDENTIFICATION

Each cold-formed steel framing member shall have be marked in accordance with the applicable building code. In addition, marking should include a legible label, stamp or embossment, at a maximum of 48 96 inches (4249 2438 mm) on center, indicating the manufacturer’s name, or initials; the evaluation report number (ESR-XXXX); the acronym “ICC-ES”; material minimum base metal thickness (uncoated) in decimal thickness or mile; minimum specified yield strength [if greater than 33 ksi (228 MPa)]; coating grade [if G60 or greater]; and inspection agency name or logo and manufacturing equipment serial number (if cold-
formed steel framing members are field-manufactured in accordance with Section 6.1.2). In addition, for recognition under the UBC, each lift or bundle of cold-formed steel framing members shall be identified in accordance with Section 2203.3 of the UBC.

6.0 QUALITY CONTROL

6.1 Manufacturing:

6.1.1 Manufacturing Facility: The manufacturer of the cold-formed steel framing members shall maintain an in-house quality control program. The type of material utilized and the level of quality assurance shall be documented in a quality control manual submitted to ICC-ES. The quality control manual shall include sufficient detail to verify that each type of steel complies with that specified in the evaluation report.

6.1.2 Field Manufacturing: The manufacturer of field-manufactured cold-formed steel framing members shall maintain a quality control program. Each field manufacturer shall be listed in a current ICC-ES evaluation report. Each incoming steel coil shall have mill certification. The type of material utilized and the level of quality assurance shall be documented in a field quality control manual that shall include sufficient detail to verify that each type of steel complies with that specified in the evaluation report and with the requirements in Sections 6.2 through 6.7 of this acceptance criteria, excluding Subsection 6.2.2. In addition, the quality control manual shall address the following:

- A monitoring program for each piece of field-manufacturing equipment, to be provided by an inspection agency accredited by the International Accreditation Service (IAS) or as otherwise acceptable to ICC-ES, with inspections to occur at a minimum frequency of once every quarter.

- Environmental conditions, such as temperature range and moisture limitations, for the operation of the field-manufacturing equipment.

- Labeling of the cold-formed steel framing members with the serial number of the field-manufacturing equipment and with information in accordance with Section 5.0 of this acceptance criteria.

6.2 Tests shall verify the following: Steel thickness (uncoated), yield strength, tensile strength, total elongation, and with information in accordance with Section 5.0 of this acceptance criteria. Where required by Section A3.3 of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications, or Section A2.3 of AISI-NASPEC, verification of ductility shall be included.

6.2.1 For steel specified as complying with one of the steel specifications noted in Section A3.1 of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications; or Section A2.1 of AISI-NASPEC, test data for each incoming steel coil shall be from independent laboratory tests or in-house testing with calibrated test equipment.

6.2.2 For steel permitted under Sections A3.2 and A3.3 of the 1986 ASD Specifications, 1991 LRFD Specifications, or 1996 Specifications; or Sections A2.2 and A2.3 of AISI-NASPEC, test data for each incoming steel coil shall be from independent laboratory tests or in-house testing with calibrated test equipment. Calibration certificates shall indicate traceability to national standards of measurement. The manufacturer shall have an established program for the calibration and verification of its measuring and test equipment.

6.3 Records of all mill certificates, independent laboratory tests and in-house tests shall be retained by the manufacturer for a minimum of one year.

6.4 Periodic Measurements:

6.4.1 Periodic measurements of material base metal thickness (uncoated) are not required for steel coils that have mill certificates. Method of verification of the base metal thickness of the master coils that have mill certificates shall be detailed in the quality control manual.

6.4.2 Material without mill certification requires periodic measurement of material base metal thickness (uncoated). Measurements of material shall be performed with calibrated equipment, either in-house or by an independent laboratory.

6.4.2.1 Test specimens for periodic testing shall consist of one out of every 250 pieces for nonbearing studs and tracks and one out of every 100 pieces for bearing studs and joists.

6.4.2.2 Alternative specimen testing for the material thickness can be accomplished by measuring each final coil at a minimum of one measurement per 2,000 linear feet (610 m) for nonbearing studs and tracks and one measurement per 800 linear feet (245 m) for bearing studs and joists.

6.4.2.3 Another alternative is to measure each final coil at three locations: the beginning, the end, and at midpoint. Final coil is defined as the steel coil that has been slit into its final width prior to roll forming into a product without additional slitting.

6.4.3 Measurement may be of the total material thickness, including coating, provided complete details covering the methods of determining uncoated steel thickness are included in the quality control manual.

6.4.4 Description of test method shall be documented in the quality control manual. Measurements shall be of the uncoated base metal.

6.5 Additional quality control testing may be necessary as determined by ICC-ES when method No. 1, full section tensile tests, or No. 2, stub column tests, as defined in Section A5.2.2 (a) of the 1986 ASD Specifications and 1991 LRFD Specifications, and Section A7.2 (a) of the 1996 Specifications and AISI-NASPEC is used for strength increase from cold work of forming.

6.6 Quality control tests shall be conducted in accordance with the following:

6.6.1 Yield strength—ASTM A 370.

6.6.2 Tensile strength—ASTM A 370.

6.6.3 Ductility—Section A3.3 of the 1986 ASD Specifications, 1991 LRFD Specifications and 1996 Specifications and Section A2.3 of AISI-NASPEC.

6.6.4 Elongation—Section A3.3 of the 1986 ASD Specifications, 1991 LRFD Specifications and 1996 Specifications and Section A2.3 of AISI-NASPEC.
6.6.5 Coating—Zinc coating hot-dip process—ASTM A924, Section 7.1.4. Other coatings are acceptable provided coatings comply with national standards.

6.7 Minimum conditions of acceptance for each test shall be specified in the in-house quality control manual for each specified steel. In addition to the tests listed in Section 6.1, the manual shall include the following:

6.7.1 Minimum yield strength used in design, or minimum yield stress prior to yield strength increase due to cold work of forming, if applicable.

6.7.2 Minimum base steel thickness (uncoated) allowed for each thickness recognized in an evaluation report. Minimum bare steel thickness shall not be less than 95 percent of the design thickness.
### Table 1—Typical Base-Metal Thicknesses

<table>
<thead>
<tr>
<th>Design Thickness</th>
<th>Minimum Thickness</th>
<th>Old Reference Gage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inch</td>
<td>Mils</td>
</tr>
<tr>
<td>0.0172</td>
<td>0.0163</td>
<td>26</td>
</tr>
<tr>
<td>0.0188</td>
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<td>25</td>
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<tr>
<td>0.0200</td>
<td>0.0200</td>
<td>22</td>
</tr>
<tr>
<td>0.0242</td>
<td>0.0246</td>
<td>20—drywall</td>
</tr>
<tr>
<td>0.0346</td>
<td>0.0329</td>
<td>20—structural</td>
</tr>
<tr>
<td>0.0428</td>
<td>0.0428</td>
<td>18</td>
</tr>
<tr>
<td>0.0528</td>
<td>0.0528</td>
<td>16</td>
</tr>
<tr>
<td>0.0677</td>
<td>0.0677</td>
<td>14</td>
</tr>
<tr>
<td>0.0966</td>
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<td>10</td>
</tr>
<tr>
<td>0.1180</td>
<td>0.1180</td>
<td>0.95</td>
</tr>
</tbody>
</table>

For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm.

- Dimensions are inches or mils, uncoated.
- U.S. standard gage for uncoated hot- and cold-rolled sheets. Gage numbers are only provided as a reference and should not be used to order, design, or specify steel studs, joists, or tracks.
- Minimum thickness of material delivered to the jobsite.
- Design thickness of cold-formed steel framing members shall not exceed the minimum thickness divided by 0.95.
PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR COLD-FORMED STEEL FRAMING MEMBERS

APPENDIX B A

PERFORATED MEMBERS ANALYTICAL APPROACH TO UBC CHAPTER 22, DIVISION VI AND VII, AND AISI 1996 SPECIFICATIONS

1. Allowable axial load of perforated wall studs:

   The effective area $A_e$ at stress $F_n$ can be determined by a rational analysis assuming the web to consist of two unstiffened strips, one each side of the perforation. For axial loading, the strips are treated as uniformly compressed unstiffened elements using Section (B3.1) of the 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications. The approach has the following limitations:

   a. Web perforations shall have center-to-center spacing of not less than 24 inches (610 mm).
   b. Web perforation maximum width shall be the lesser of 0.5 times the stud depth, $d$, 2 1/2 inches (63.5 mm).
   c. Web perforation length shall not exceed 4 1/2 inches (114 mm).
   d. Minimum distance between the end of the stud and the near edge of the web perforation shall be 10 inches (254 mm).
   e. The section depth-to-thickness ratio, $d/t$, shall not be less than 20.

2. Flexural load-carrying capacity of perforated stud members:

   a. Bending—Major Axis:

   $$M_m = 0.6 \times F_y \times S_e$$

   This assumes lateral torsional buckling is precluded.

   $$S_e = \text{Effective section modulus based on an unpunched web as defined in Section [C3.1.1(a)] of the 1986 ASD Specifications, 1991 LRFD Specifications and 1996 Specifications.}$$

   $$F_y = \text{Design yield stress as determined in Section (A5.2.1) of the 1986 ASD Specifications and 1991 LRFD Specifications.}$$

   Minor Axis—Procedure is similar to determination of $A_e$ for members subjected to axial compression.

   b. Shear—Allowable shear can be estimated by applying the reduction factor, $q_s$, to the design values of Section (C3.2) of the 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications. An unpunched web should be assumed for the equations in Section (C3.2) of the 1986 ASD Specifications, 1991 LRFD Specifications and 1996 Specifications.

   $$q_s = 1.0 - 1.1 \left( \frac{a}{D} \right)$$

   $a' = \text{Depth of the opening (perforation).}$

   $D = \text{Overall depth of the web.}$

   c. Web Crippling—The following items must be considered:

   (1) If the edge of the web opening is at least equal to $1.5D$ from the edge of the bearing, no reduction in the web crippling allowable strength is required. Analysis should be based on Section (C3.4) of the 1986 ASD Specifications, 1991 LRFD Specifications or 1996 Specifications.

   (2) If the edge of the web opening is less than $1.5D$ from the edge of the bearing, the allowable code web crippling shall be reduced by using the following factor:

   $$R = [1.0 - 0.197 \left( \frac{a'}{D} \right)^2] \times [1.0 - 0.127 \left( \frac{b}{n_1} \right)^3]$$

   The equation is applicable for members having $b/n_1$ less than 2.0.

   where:

   $$n_1 = N + (D - 2t - a').$$

   $b = \text{Length of web opening.}$

   $N = \text{Actual length of bearing.}$

   $t = \text{Base steel thickness.}$

   Other variables are defined in Item 2b.

   (3) If the web opening is located within the bearing length, web stiffeners must be used.
d. Combined Bending and Shear—Design Equation (C3.3-1) of Section (C3.3) of the 1986 ASD Specifications and 1991 LRFD Specifications, and Equation (C3.3.1-1) or (C3.3.2-1) of Section C3.3 of the 1996 Specifications is applicable with modifications to the allowable shear and moment described above.

e. Combined Bending and Web Crippling—Design Equations in Section (C3.5) of the 1986 ASD Specifications. 1991 LRFD Specifications and 1996 Specifications are applicable with modifications to allowable concentrated load and moment as described above.

f. The flexural load-carrying capacity of perforated stud members is subject to the web perforation limitations noted in Sections 1a, b, c, d and e of Appendix B of this criteria.
PROPOSED REVISIONS TO THE ACCEPTANCE CRITERIA FOR COLD-FORMED STEEL FRAMING MEMBERS

APPENDIX C B

Structural Properties

<table>
<thead>
<tr>
<th>MEMBER SIZE (inches) OR DESIGNATION</th>
<th>DESIGN THICKNESS (inches)</th>
<th>WEIGHT (lbs./ft.)</th>
<th>GROSS SECTION PROPERTIES</th>
<th>EFFECTIVE SECTION PROPERTIES*</th>
<th>ALLOWABLE MOMENT M_a (in.-lbs.)*</th>
<th>TORSIONAL SECTION PROPERTIES**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Area (in²)</td>
<td>I_x (in⁴)</td>
<td>r_x (in)</td>
<td>I_y (in⁴)</td>
</tr>
<tr>
<td>For SI: 1 inch = 25.4 mm, 1 lb./ft. = 1.488 kg/m, 1 in. - lb. = 11.30 N · m.</td>
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Notes:

The extreme fiber stress of the flexural members used in design shall be noted in the structural properties tables. This stress shall be the yield stress of the base metal.

In addition, if applicable, the following statement shall be noted in the table: “Effective properties and allowable moment incorporate stress increase as a result of cold work of forming, where applicable.”

Definitions:

*Effective section properties are the properties determined from the total effective width of each element of the member and used in the design of the member in accordance with AISI-NASPEC for recognition under the IBC and UBC Chapter 22, Divisions VI or VII, of the UBC, or AISI 1996 specifications for recognition under the UBC.

1. Effective I_x is based on Procedure I of Section C3.1.1 of the 1986 ASD Specifications, 1991 LRFD Specifications and 1996 Specifications for recognition under the UBC for deflection determination at the allowable moment.

2. Effective area is the area based on using f = F_y in equation B2.1-4. (Optional.)

**Torsional section properties are optional for nonaxial load-bearing members.